Light scattering by complex ice crystals using the Boundary Element Method

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The Boundary Element Method (BEM), also known as the Method of Moments, or Surface Integral Equation Method, has recently been shown to be a competitive computational method for simulating light scattering problems [1,2]. BEM is a flexible tool offering accurate simulations even for complex scatterer configurations. BEM involves reformulating the Maxwell's equations into integral equations on the boundary of the scatterer(s). This requires the solution of large linear systems on the boundary and then extension of the solution to the interior and exterior of the scatterer via the Stratton-Chu representation formulae.

In recent years, certain strategies have been investigated to try to speed up the iterative solution of such large linear systems, including Calderòn preconditioning [3] and the use of novel basis functions [4]. In this talk, we will discuss recent developments in the solution of dielectric scattering problems using BEM, the extension of these ideas to scattering by multiple dielectric objects, and their implementation in the software library Bempp [5]. Bempp is an open source library offering fast and accurate simulation of electrostatic, acoustic and electromagnetic scattering problems.

Of particular interest to us are cases of light scattering by ice crystals found in cirrus clouds [6,7]. We will demonstrate how one can use the above theory and the Bempp library to efficiently solve examples of light scattering by single and multiple ice crystals of complex shape.

References

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